

42. Cancelled

### REMARKS

Claims 1, 10 and 16-42 have been rejected. Applicants have amended claims 1, 10, 18 20, 22 and 28; claims 17 and 42 have been cancelled; and claims 1, 10, and 18-41 remain in the application. Reexamination and reconsideration of the application are requested.

The Applicants note, with appreciation, the acceptance of the formal drawings previously submitted.

The Examiner has objected to the specification under 35 U.S.C. 132. In response, Applicants have amended the paragraph beginning on page 7, line 21 to change the term "non-linear" to "linear" as stated in the original disclosure. It is respectfully requested that the Examiner withdraw this objection.

Claim 28 has been amended as suggested by the Examiner and it is believed that this objection may now be withdrawn.

Claims 1, 10 and 16-42 have been rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicants will address each claim in the order presented by the Examiner.

#### Claim 1

The Examiner states that "Claim 1 has been amended to include the limitations of a continuously-emitting neutron source, a high-resolution detector, and creating a single high

resolutions spectrum of at least 4096 channel which was not described in the specification”.

In response, Applicants have amended claim 1 to replace “continuously-emitting neutron source” with “an isotopic neutron source” (support in the specification is found at page 1, line 21; page 3, line 25 through page 4, line 2; page 4, lines 18-22; page 11, line 25, since one skilled in the art will clearly recognize that californium-252 is an isotopic neutron source). Additionally, Applicants have deleted the reference to a “high-resolution” detector and replaced it with “high purity germanium” detector (support for this amendment is found in the specification at page 13, lines 7-10). And finally, applicants have replaced the language of “creating a single high resolution spectrum of at least 4096 channels” with language of “creating a single spectrum of between 4096 and 16384 channels”. The fact that a single spectrum is used is shown in Fig. 3 and support of the range of channels is found in the specification at page 6, lines 19-23. In view of the above amendments, it is believed that claim 1, and claims 16-27 which depend therefrom are now in a condition for allowance.

#### Claim 10

The Examiner states that “Claim 10 has been amended to include the limitations of a high-resolution multichannel analyzer, a high-resolution gamma-ray detector, comparing said peak energies from said first data to said peaks and peak centroids from said second data, calculating intensities of said peaks from said extracted net areas and counting times, identifying chemical elements and their concentrations contained in said chemical substance from said energies and intensities of said gamma-ray peaks and said second data, and identifying said chemical substance by determining a concentration which was not described in the specification”.

In response to the Examiner's rejection of claim 10, Applicants have changed "high resolution multichannel analyzer" to "multichannel analyzer". Support in the specification for this amendment is found for example at page 6, lines 12-15; and page 8, lines 12-20. The term "high-resolution detector" has been changed to "high-purity germanium detector" and support in the specification is found a page 13, lines 7-10.

Applicants respectfully assert that the language "comparing said peak energies form said first data to said peaks and peak centroids from said second data" is supported in the specification. For example, support for this language of claim 10 may be found at page 8, lines 3-25; page 20 lines 5-14; page 24, line 23 through page 25, line 3; Figures 7A and 7b (steps 102, 104 and 110); and Figures 8A and 8B (steps 114, 115 and 116).

Also support in the specification for the language "calculating intensifies of said peaks from said extract net areas and counting times is found at page 8, lines 5-10, page 27, line 4 through page 33. Line 1 and Table I on page 33.

The claim limitation of "identifying chemical elements and their concentrations" has been replaced with "identifying chemical elements and their ratios". Support for this amendment is found in the specification at page 8, lines 10-25; page 16, lines 6-25; and page 17, lines 20-26.

The limitation of "identifying by determining an amount, if any, of a first element concentration and at least one second element concentration" had been changed to read "identifying by determining a presence, if any, of a first element and at least one second element". Support in the specification for this amendment is found at page 5, lines 25-26; page 8, lines 10-25; page 16, lines 6-15; and Figures 9A and 9B.

## Claim 28

The examiner states that “newly added claim 28 include the limitations of a continuous neutron source, a high-resolution detector, determining peak centroids and net peak areas extracted from said calibrated measure spectrum to determine counting rates for chemical elements of interest, identifying chemical elements and their concentrations, identifying by determining an amount, if any, of a first element concentration and at least one second element concentration which was not described in the specification.”

In response, Applicants have changed “continuous neutron source” to “isotopic neutron source” (support in the specification being found at page 1, line 21; page 3, line 25 through page 4, line 2; page 4, lines 18-22; and page 11, line 25).

The terms “high-resolution detector” has been changed to “high-purity germanium detector” (support for this amendment is found in the specification at page 13, lines 7-10).

Applicants respectfully assert that the limitation of “determining peak centroids and net peak areas extracted from said calibrated measure spectrum to determine counting rates for chemical elements of interest” is supported by the specification at page 8, lines 5-1).

The limitation of “identifying chemical elements and their concentrations” has been replaced with “identifying chemical elements and their ratios”. Support for this amendment is found in the specification at page 8, lines 10-25; page 16, lines 6-25; and page 17, lines 20-26.

The claim limitation of “identifying by determining an amount, if any, of a first element concentration and at least one second element concentration which was not described in the specification” has been replaced with “identifying by determining a presence, if any, of a first element and at least one second element ratio”. Support in the specification for this amendment

is found at page 5, lines 25-26; page 8, lines 10-25; page 16, lines 6-15; and Figures 9A and 9B.

#### Claim 17

Claim 17 has been cancelled.

#### Claim 22

The Examiner states that in claim 22, the limitation of determining a concentration was not described in the specification. Applicants have amended claim 22 to define this limitation as determining a relative amount of the first element, and a relative amount of a second element. Support in the specification for this amendment is found on page 6, line 3-7.

#### Claim 42

Claim 42 has been cancelled.

In view of the amendments to claims 1, 10, 28, and 22, and the cancellation of claims 17 and 42, it is respectfully requested that the Examiner withdraw the rejection under 35 U.S.C. 112, first paragraph, since all claim limitations are now supported by the specification and reasonably conveys to one skilled in the art that the inventors, at the time of the application was filed, had possession of the claimed invention.

Claims 18 and 20 were rejected under 35 U.S.C. 112, second paragraph as having insufficient antecedent basis. In response, claims 18 and 20 have been amended to provide

proper antecedent basis. No new matter was added. It is respectfully requested that this ground for rejection be withdrawn by the Examiner.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached pages are captioned **"Version with markings to show changes made"**.

In view of the above amendment and remarks, Applicants believe this application should be considered ready for allowance and Applicants earnestly solicit an early notice of the same. Should the Examiner be of the opinion that a telephone conference would expedite prosecution of the subject application, please call the undersigned at the below-listed number.

RESPECTFULLY SUBMITTED,

By



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## VERSION WITH MARKINGS TO SHOW CHANGES MADE

### In the Specification:

The following paragraphs have been amended as follows: Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

The paragraph beginning on page 7, line 21 through page 8, line 1:

To determine the calibration constants, the algorithm first searches the spectrum for peaks significantly above the background. The centroids of these peaks are matched to a specified pattern to identify the individual peaks. Then, a ~~linear~~ non-linear least square fit of experimental peak energies versus expected peak energies is performed to determine the three constants.

### In the Claims:

The claims have been amended as follows: Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

## CLAIMS

1. (Twice Amended) A method for identifying a chemical substance, the method comprising:  
exposing said chemical substance to neutrons from ~~a continuously emitting~~ an isotopic neutron source;

measuring, with a ~~high-resolution~~ high purity germanium detector, gamma rays emitted by said chemical substance as a result of exposure to said neutrons;

creating a single, ~~high-resolution~~ spectrum of ~~at least~~ between 4096 and 16384 channels and a detection count per spectrum channel, said detection count corresponding to the number of detected gamma rays;

calibrating an energy scale of said spectrum;

performing a peak-by-peak analysis of the corresponding gamma-ray energies of chemical elements of interest on said spectrum; and

identifying said chemical substance based on said peak-by-peak analysis of said spectrum.

10. (Twice Amended) A system for identifying a chemical substance, said system comprising:

a neutron source for delivering neutrons into said chemical substance;

a ~~high-resolution~~ multichannel analyzer operatively associated with a ~~high-resolution~~ high purity germanium gamma-ray detector;

a computer operatively associated with said multichannel analyzer; and

a computer-readable medium operatively associated with said computer, said computer-readable medium containing instructions for controlling said computer to identify said chemical substance by:

storing first data representative of gamma-ray peak energies corresponding to at least one pre-selected chemical element;



sorting said first data in a pre-selected order having a first peak energy and a last peak energy;

receiving second data representative of gamma-ray counts, wherein said gamma rays are generated by said chemical substance as a result of exposure to said neutrons, and said second data having peaks associated therewith;

searching said second data in a pre-selected order having a first peak and a last peak;

comparing said energies from said first data to said peaks from said second data by comparing said peak energies from said first data to said peaks and peak centroids from said second data;

calibrating an energy scale of said gamma-ray spectrum from said centroid positions and said first data;

extracting net areas and energies of said peaks;

calculating intensities of said peaks from said extracted net areas and counting times;

identifying chemical elements and their ~~concentrations~~ ratios contained in said chemical substance from said energies and intensities of said gamma-ray peaks and said second data;

identifying said chemical substance by determining a ~~concentration~~ presence, if any, of a first element selected from the group of phosphorous and chlorine, and a ~~concentration~~ presence, if any, of second elements is selected from the group consisting of arsenic, boron, hydrogen, nitrogen, oxygen, phosphorous, sulfur, silicon, titanium and zinc.

18. (Once Amended) The method of claim 1 further comprising displaying ~~the identified~~ chemical elements comprising said identified chemical substance.

20. (Once Amended) The method of claim + 18 further comprising displaying a confidence level associated with the identified chemical elements.

22. (Once Amended) The method of claim 1 wherein the step of identifying the chemical substance comprises determining a ~~concentration~~ presence, if any, of a first chemical element selected from the group of phosphorous and chlorine, and a ~~concentration~~ ratio of second elements is selected from the group consisting of arsenic, boron, hydrogen, nitrogen, oxygen, phosphorous, sulfur, silicon, titanium and zinc.

28. (Once Amended) A method for identifying a chemical substance, the method ~~comprising::~~ comprising:

inducing neutrons from a ~~continuous~~ an isotopic neutron source into a chemical substance, said neutrons interacting within the chemical substance to generate characteristic gamma-rays;

measuring, with a ~~high-resolution~~ high purity germanium detector, energies of said gamma-rays to create a single gamma-ray energy spectrum;

selecting a data file containing spectral information of at least one known chemical element and gamma-ray peaks associated therewith, said data file being used to calibrate said measured gamma-ray energy spectrum;

performing a directed peak fit analysis comprising determining peak centroids and net peak areas extracted from said calibrated, measured spectrum to determine gamma-ray counting rates for chemical elements of interest;

identifying chemical elements and their ~~concentrations~~ ratios contained in said chemical substance;

identifying said chemical substance by determining ~~an amount~~ a presence, if any, of a first element ~~concentration~~ and at least one second element ~~concentration~~.